Fossil Dinoflagellates and Hystrichospheres in Australian Freshwater Deposits

DURING investigations of algae and aplanospores in Holocene peat deposits of south-western Australia[1], fossil dinoflagellates and hystrichospheres have been found; these are the first representatives of these groups to be discovered in non-marine deposits. The dinoflagellates are referable to the genera *Gymnodinium* (Fig. 1*b*), *?Peridinium* (Fig. 1*a*), *Palaeohystrichophora* and to an undescribed genus of the family Peridiniaceae; they are found in assemblages from two localities near Lake Muir, about 40 miles north of Walpole, Western Australia, and from Myalup Swamp, 24 miles north-north-east of Bunbury, Western Australia. The hystrichospheres are referable to six undescribed species of the genus *Baltisphaeridium* (Figs. 1*c* and 1*d*): they are present in assemblages from the above localities and from deposits at Boggy Lake, 6 miles south-west of Walpole, Western Australia. In no case do these species afford evidence of dinoflagellate affinities.

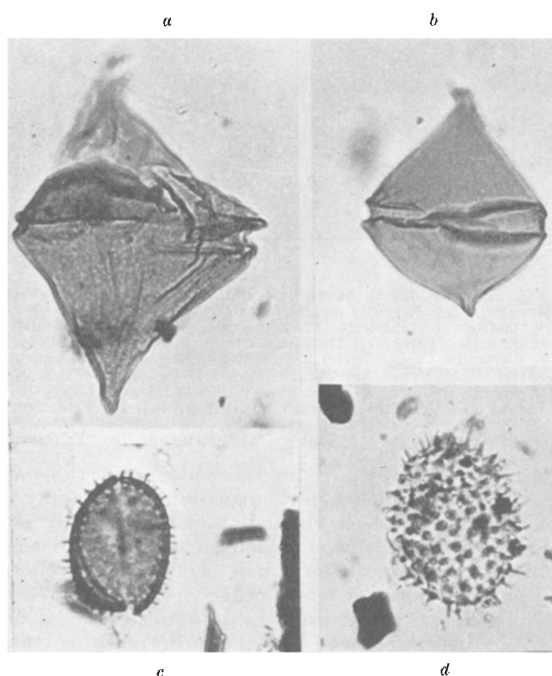

Fig. 1. Fossil freshwater dinoflagellates and hystrichospheres from south-west Australian peats. *a* (?) *Peridinium* sp. West Lake Muir at 30–40 cm. depth; *b*, *Gymnodinium* sp. West Lake Muir at 30–40 cm. depth; *c*, *Baltisphaeridium* sp. *A*, boggy lake at 90–100 cm. depth; *d*, *Baltisphaeridium* sp. *A*, at 20–30 cm. depth. (× *c*. 600)

Since the hystrichospheres have been regarded hitherto as "characteristically marine"[2] and have been considered as potentially reliable marine indices[3,4], their presence in undoubtedly non-marine deposits is of particular interest. Although there was some variation in relative salinity between the localities, in no case were the waters even brackish in terms of their absolute salinity. The assemblages may have originated by wind dispersal of cysts; evidence of the dispersal of aplanospores by this means has already been recorded[1]. The formation of the bogs was not related to any marine incursion, and the microplankton assemblages cannot be regarded as relict marine floras.

Dinoflagellates and hystrichospheres are absent from assemblages from peat profiles at other localities studied in Western Australia. There are no obvious special factors to account for the presence of these organisms in the localities listed and their absence elsewhere.

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Uptake of Phenylalanine by *Tetrahymena pyriformis*

THE nutritional requirements of *Tetrahymena pyriformis* are well known, and it can be cultured in a chemically defined medium. Nevertheless, some aspects of its feeding are still not clear. In nature the organisms are believed to feed phagotrophically on bacteria[1]. In synthetic media, however, food vacuoles are rarely seen. Although Seaman[2] found that vacuole formation could be stimulated by the addition of proteose peptone-yeast extract to the medium, the phagotrophic activity induced was not sufficient to supply the energy requirements of the organisms.

Uptake of amino-acids from solution has been reported for both micro-organisms and metazoans[3–5]. In some cases, membrane transport has been implicated. Since phagotrophy does not account for the obvious ability of *Tetrahymena* to thrive on a suitable mixture of small organic molecules, it seemed desirable to investigate this possibility.

Tetrahymena pyriformis B was grown axenically in 1 per cent proteose peptone, 0·05 per cent yeast extract, with added ferrous sulphate ($8·95 \times 10^{-5}$ *M*) and sodium-ethylenediamine tetraacetic acid ($6·87 \times 10^{-5}$ *M*). Cells were gathered at the end of the log phase by centrifugation and washed and suspended in *M*/100 phosphate buffer, *p*H 6·4, at a concentration of 10^6 cells/ml. DL-phenylalanine-3-^{14}C was added and samples were taken at suitable time-intervals. Samples were collected by filtering 1 ml. of the cell suspension through a 1-in. *AM*–1 Polypore membrane filter (pore size, 5μ). The filter was then washed with 8–10 vols. of phosphate buffer. Radioactivity in the organisms was determined by measuring the labelled material restrained by the filter using a thin-window Geiger tube. The technique was checked by washing labelled cells with non-radioactive buffer and measuring the radioactivity of samples dried on aluminium planchets. The results presented have been corrected for the greater self-absorption encountered in the filter disks.

At concentrations of about 1 μgm./ml., 40–50 per cent of the DL-phenylalanine was removed in the first 20 min. No additional material was removed if incubation was continued for longer periods. The rate of uptake appeared linear for the first 10 min. of incubation. The relation between the initial rate of

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